

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
US Department of Commerce  
United States Patent and Trademark  
Office, PCT  
2011 South Clark Place Room  
CP2/5C24  
Arlington, VA 22202  
ETATS-UNIS D'AMERIQUE  
in its capacity as elected Office

Date of mailing (day/month/year) 25 April 2001 (25.04.01)	
International application No. PCT/KR00/00883	Applicant's or agent's file reference OPP990863KR
International filing date (day/month/year) 10 August 2000 (10.08.00)	Priority date (day/month/year) 17 August 1999 (17.08.99)
Applicant AHN, Yong-Sik et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:14 March 2001 (14.03.01)☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Juan Cruz Telephone No.: (41-22) 338.83.38
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## PCT

(PCT Article 18 and Rules 43 and 44)

This international search report has been prepared by the International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

- Form PCT/ISA/210 (first sheet) (July 1998)

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/KR 00/00883

## CLASSIFICATION OF SUBJECT MATTER

IPC<sup>7</sup>: G03F 7/027

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC<sup>7</sup>: G08F; G03C; G03F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, PAJ, WPI, CAS

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0770923 A1 (TOKYO OHKA KOGYO CO., LTD.) 2 May 1997 (02.05.97) claim 1, page 3, lines 42-56.	1,2
X	US 5356754 A (KUSHI et al.) 18 October 1994 (18.10.94) claims 1-4.	2-4,8-13,16
X	US 4692396 A (UCHIDA) 8 September 1987 (08.09.87) claims 1 & 2, examples.	2- 4,6,8,12,13,15, 16
X	US 4629680 A (IWASAKI et al.) 16 December 1986 (16.12.86) claims 1 & 10, column 7, lines 40-66.	2-4,6,8- 13,15,16
X	US 4495271 A (GEISSLER et al.) 22 January 1985 (22.01.85) claim 1, examples.	2-4,6,8- 13,15,16

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

\* Special categories of cited documents:

- „A“ document defining the general state of the art which is not considered to be of particular relevance
- „E“ earlier application or patent but published on or after the international filing date
- „L“ document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- „O“ document referring to an oral disclosure, use, exhibition or other means
- „P“ document published prior to the international filing date but later than the priority date claimed

- „T“ later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- „X“ document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- „Y“ document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- „&“ document member of the same patent family

Date of the actual completion of the international search

17 November 2000 (17.11.2000)

Date of mailing of the international search report

16 February 2001 (16.02.2001)

Name and mailing address of the ISA/AT  
Austrian Patent Office  
Kohlmarkt 8-10; A-1014 Vienna  
Facsimile No. 1/53424/535

Authorized officer

PUSTERER

Telephone No. 1/53424/311

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR 00/00883

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4239849 A (LIPSON et al.) 16 December 1980 (16.12.80) claims 1-8, examples.	2-4,8-13,16
X	US 5419998 A (MAYES et al.) 30 May 1995 (30.05.95) claims 1,3-7 & 10, table 1, examples.	2-4,8,12,16

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR 00/00883

Patent document cited in search report			Publication date	Patent family member(s)			Publication date
EP	A1	770923	02-05-1997	JP	A2	9127692	16-05-1997
				US	A	5776995	07-07-1998
				US	A	5919569	06-07-1999
				JP	A2	9152713	10-06-1997
US	A	4239849	16-12-1980	FR	B1	2339185	14-03-1980
				ZA	A	7507984	29-12-1976
				FR	A1	2339185	19-08-1977
US	A	4495271	22-01-1985	AT	E	17792	15-02-1986
				DE	A1	3120052	09-12-1982
				DE	C0	3268767	13-03-1986
				EP	A2	65285	24-11-1982
				EP	A3	65285	16-02-1983
				EP	B1	65285	29-01-1986
				HK	A	658/87	18-09-1987
				JP	A2	57196231	02-12-1982
				JP	B4	4047812	05-08-1992
				KR	B1	8801434	08-08-1988
				SG	A	336/87	17-07-1987
				DE	A1	3503115	01-08-1985
US	A	4629680	16-12-1986	JP	A2	60159743	21-08-1985
				JP	A2	60258539	20-12-1985
				CA	A1	1236236	03-05-1988
US	A	4692396	08-09-1987	DE	A1	3512684	17-10-1985
				JP	A2	60214354	26-10-1985
				JP	B4	6042073	01-06-1994
				KR	B1	9108790	21-10-1991
				none			
US	A	5356754	18-10-1994	CA	AA	2076727	01-03-1993
US	A	5419998	30-05-1995	DE	C0	69205530	23-11-1995
				DE	T2	69205530	14-03-1996
				EP	A1	529643	03-03-1993
				EP	B1	529643	18-10-1995
				JP	A2	6138656	20-05-1994

## PCT REQUEST

OPP990863KR

Original (for SUBMISSION) - printed on 10.08.2000 02:27:59 PM

<b>0</b>	<b>For receiving Office use only</b>	
<b>0-1</b>	International Application No.	
<b>0-2</b>	International Filing Date	
<b>0-3</b>	Name of receiving Office and "PCT International Application"	
<b>0-4</b>	<b>Form - PCT/RO/101 PCT Request Prepared using</b>	<b>PCT-EASY, Version 2.91 (updated 01.07.2000)</b>
<b>0-5</b>	<b>Petition</b> The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
<b>0-6</b>	<b>Receiving Office (specified by the applicant)</b>	<b>Korean Industrial Property Office (RO/KR)</b>
<b>0-7</b>	<b>Applicant's or agent's file reference</b>	<b>OPP990863KR</b>
<b>I</b>	<b>Title of invention</b>	<b>PHOTOSENSITIVE RESIN COMPOSITION</b>
<b>II</b>	<b>Applicant</b>	
<b>II-1</b>	This person is:	<b>applicant only</b>
<b>II-2</b>	Applicant for	<b>all designated States except US</b>
<b>II-4</b>	Name	<b>LG CHEMICAL LTD.</b>
<b>II-5</b>	Address:	<b>LG Twin Tower, Yoido-dong 20, Yongsongpo-ku, 150-721 Seoul Republic of Korea</b>
<b>II-6</b>	State of nationality	<b>KR</b>
<b>II-7</b>	State of residence	<b>KR</b>
<b>II-8</b>	Telephone No.	<b>+82 42 866 2070</b>
<b>II-9</b>	Facsimile No.	<b>+82 42 863 2053</b>
<b>III-1</b>	<b>Applicant and/or inventor</b>	
<b>III-1-1</b>	This person is:	<b>applicant and inventor</b>
<b>III-1-2</b>	Applicant for	<b>US only</b>
<b>III-1-4</b>	Name (LAST, First)	<b>AHN, Yong-Sik</b>
<b>III-1-5</b>	Address:	<b>Joocho Villa Na-101, 1076-1, Namhyun-dong, Kwanak-ku, 151-800 Seoul Republic of Korea</b>
<b>III-1-6</b>	State of nationality	<b>KR</b>
<b>III-1-7</b>	State of residence	<b>KR</b>

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III-2	<b>Applicant and/or inventor</b>	
III-2-1	This person is:	applicant and inventor
III-2-2	Applicant for	US only
III-2-4	Name (LAST, First)	KIM, Kyung-Jun
III-2-5	Address:	LG Apt. 6-106 Doryong-dong, Youseong-ku, 305-340 Taejeon-city Republic of Korea
III-2-6	State of nationality	KR
III-2-7	State of residence	KR
III-3	<b>Applicant and/or inventor</b>	
III-3-1	This person is:	applicant and inventor
III-3-2	Applicant for	US only
III-3-4	Name (LAST, First)	HWANG, Yun-Il
III-3-5	Address:	Kumnamoo Apt. 201-1303 Doonsan-dong, Seo-ku, 302-736 Taejeon-city Republic of Korea
III-3-6	State of nationality	KR
III-3-7	State of residence	KR
IV-1	<b>Agent or common representative; or address for correspondence</b>	
	The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name (LAST, First)	KIM, Seong-Ki
IV-1-2	Address:	9th Teheran Bd., 825-33, Yoksam-dong, Kangnam-ku, 135-080 Seoul Republic of Korea
IV-1-3	Telephone No.	+82 2 3458 0800
IV-1-4	Facsimile No.	+82 2 539 0758
IV-1-5	e-mail	email@mutualip.com
V	<b>Designation of States</b>	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	JP US

## PCT REQUEST

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V-5	<b>Precautionary Designation Statement</b> In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.		
V-6	<b>Exclusion(s) from precautionary designations</b>	NONE	
VI-1	<b>Priority claim of earlier national application</b>		
VI-1-1	Filing date	17 August 1999 (17.08.1999)	
VI-1-2	Number	1999-33884	
VI-1-3	Country	KR	
VII-1	<b>International Searching Authority Chosen</b>	Austrian Patent Office (ISA/AT)	
VIII	<b>Check list</b>	number of sheets	electronic file(s) attached
VIII-1	Request	4	-
VIII-2	Description	15	-
VIII-3	Claims	5	-
VIII-4	Abstract	1	ab990863kr.txt
VIII-5	Drawings	0	-
VIII-7	TOTAL	25	
VIII-8	<b>Accompanying items</b>	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-9	Separate signed power of attorney	✓	-
VIII-12	Priority document(s)	Item(s) VI-1	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-18	<b>Figure of the drawings which should accompany the abstract</b>		
VIII-19	<b>Language of filing of the international application</b>	English	
IX-1	<b>Signature of applicant or agent</b>		
IX-1-1	Name (LAST, First)	KIM, Seong-Ki	

## FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	



**PCT REQUEST**

OPP990863KR

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10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	<b>ISA/AT</b>
10-6	Transmittal of search copy delayed until search fee is paid	

**FOR INTERNATIONAL BUREAU USE ONLY**

11-1	Date of receipt of the record copy by the International Bureau	
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**PCT (ANNEX - FEE CALCULATION SHEET)**

OPP990863KR

Original (for SUBMISSION) - printed on 10.08.2000 02:27:59 PM

(This sheet is not part of and does not count as a sheet of the international application)

<b>0</b>	<b>For receiving Office use only</b>		
<b>0-1</b>	International Application No.		
<b>0-2</b>	Date stamp of the receiving Office		
<b>0-4</b>	<b>Form - PCT/RO/101 (Annex)</b>		
<b>0-4-1</b>	PCT Fee Calculation Sheet Prepared using	<b>PCT-EASY Version 2.91 (updated 01.07.2000)</b>	
<b>0-9</b>	Applicant's or agent's file reference	<b>OPP990863KR</b>	
<b>2</b>	Applicant	<b>LG CHEMICAL LTD., et al.</b>	
<b>12</b>	<b>Calculation of prescribed fees</b>	<b>fee amount/multiplier</b>	<b>total amounts (KRW)</b>
12-1	Transmittal fee T	⇒	45,000
12-2	Search fee S	⇒	168,700
12-3	International fee Basic fee (first 30 sheets) b1	444,000	
12-4	Remaining sheets	0	
12-5	Additional amount (X)	10,200	
12-6	Total additional amount b2	0	
12-7	b1 + b2 = B	444,000	
12-8	Designation fees Number of designations contained in international application	3	
12-9	Number of designation fees payable (maximum 8)	3	
12-10	Amount of designation fee (X)	95,600	
12-11	Total designation fees D	286,800	
12-12	PCT-EASY fee reduction R	-136,600	
12-13	Total International fee (B+D-R) I	⇒	594,200
<b>12-17</b>	<b>TOTAL FEES PAYABLE (T+S+I+P)</b>	⇒	<b>807,900</b>
<b>12-19</b>	Mode of payment	<b>cash</b>	

**VALIDATION LOG AND REMARKS**

## PCT (ANNEX - FEE CALCULATION SHEET)

OPP990863KR

Original (for SUBMISSION) - printed on 10.08.2000 02:27:59 PM

13-2-2	Validation messages States	<p>Green?</p> <p>More designations could be made. The following States have not been designated: AP:( GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW); EA:( AM, AZ, BY, KG, KZ, MD, RU, TJ, TM); OA:( BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG); AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, LI, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW. Please verify.</p>
13-2-6	Validation messages Contents	<p>Green?</p> <p>The international application contains no drawings. Please verify.</p>
13-2-10	Validation messages For receiving Office/International Bureau use only	<p>Green?</p> <p>Verify electronic data for consistency against printed form.</p>

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ KR

# PCT

## CHAPTER II

### DEMAND

under Article 31 of the Patent Cooperation Treaty:

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only	
Identification of IPEA	Date of receipt of DEMAND
<b>Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION</b>	
Applicant's or agent's file reference OPP990863KR	
International application No. PCT/KR00/00883	International filing date (day/month/year) 10 August 2000(10.08.2000)
(Earliest) Priority date (day/month/year) 17 August 1999(17.08.1999)	
Title of invention PHOTOSENSITIVE RESIN COMPOSITION	
<b>Box No. II APPLICANT(S)</b>	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) LG CHEMICAL LTD. LG Twin Tower, Yoido-dong 20, Yongsongpo-ku, Seoul 150-721, Republic of Korea	
Telephone No. +82 42 866 2070	
Facsimile No. +82 42 863 2053	
Teleprinter No.	
Applicant's registration No. with the Office	
State (that is, country) of nationality: KR	State (that is, country) of residence: KR
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) AHN, Yong-Sik Jooho Villa Na-101, 1076-1, Namhyun-dong, Kwanak-ku, Seoul 151-800, Republic of Korea	
State (that is, country) of nationality: KR	State (that is, country) of residence: KR
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) KIM, Kyung-Jun LG Apt. 6-106, Doryong-dong, Youseong-ku Taejeon-city 305-340, Republic of Korea	
State (that is, country) of nationality: KR	State (that is, country) of residence: KR
<input checked="" type="checkbox"/> Further applicants are indicated on a continuation sheet.	

**Continuation of Box No. II APPLICANT(S)**

*If none of the following sub-boxes is used, this sheet should not be included in the demand.*

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

HWANG, Yun-Il

Kumnamoo Apt. 201-1303, Doonsan-dong, Seo-ku

Taejeon-city 302-736, Republic of Korea

State *(that is, country)* of nationality:

KR

State *(that is, country)* of residence:

KR

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

☐

Further applicants are indicated on another continuation sheet.

**Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The following person is ☒ agent ☐ common representative  
 and ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.  
☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.  
☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: (Family name followed by given name; for a legal entity, full official designation.  
 The address must include postal code and name of country.)

KIM, Seong-Ki  
 9th Teheran Bld., 825-33, Yoksam-dong, Kangnam-ku,  
 Seoul 135-080 Republic of Korea

Telephone No.

+82 2 3458 0800

Facsimile No.

+82 2 539 0758

Teleprinter No.

Agent's registration No. with the Office

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:\***

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filed

the description ☐ as originally filed  
☐ as amended under Article 34

the claims ☐ as originally filed  
☐ as amended under Article 19 (together with any accompanying statement)  
☐ as amended under Article 34

the drawings ☐ as originally filed  
☐ as amended under Article 34

2. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). (This check-box may be marked only where the time limit under Article 19 has not yet expired.)

\* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

**Language for the purposes of international preliminary examination:** English

☒ which is the language in which the international application was filed.

☐ which is the language of a translation furnished for the purposes of international search.

☐ which is the language of publication of the international application.

☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

**Box No. V ELECTION OF STATES**

The applicant hereby elects all eligible States (that is, all States which have been designated and which are bound by Chapter II of the PCT)

excluding the following States which the applicant wishes not to elect:

**Box No. VI CHECK LIST**

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- |  |   |        |
|--|---|--------|
| 1. translation of international application                              | : | sheets |
| 2. amendments under Article 34   | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19  | : | sheets |
| 5. letter  | : | sheets |
| 6. other ( <i>specify</i> )  | : | sheets |

For International Preliminary Examining Authority use only

received not received

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- |  |  |
|--|--|
| 1. <input checked="" type="checkbox"/> fee calculation sheet                             | 5. <input type="checkbox"/> statement explaining lack of signature     |
| 2. <input type="checkbox"/> original separate power of attorney                          | 6. <input type="checkbox"/> sequence listing in computer readable form |
| 3. <input type="checkbox"/> original general power of attorney                           | 7. <input type="checkbox"/> other ( <i>specify</i> ):                  |
| 4. <input type="checkbox"/> copy of general power of attorney; reference number, if any: |  |

**Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE**

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

KIM, Seong-Ki

**For International Preliminary Examining Authority use only**

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

**For International Bureau use only**

Demand received from IPEA on:

COPY FOR IB

PATENT COOPERATION TREATY

**PCT**

3

REC'D 11 JAN 2002

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

WIPO

PCT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference OPP990863KR	<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. <b>PCT/KR00/00883</b>	International filing date (day/month/year) 10 AUGUST 2000 (10.08.2000)	Priority date (day/month/year) 17 AUGUST 1999 (17.08.1999)
International Patent Classification (IPC) or national classification and IPC  <b>IPC7 G03F 7/027</b>		
Applicant  LG CHEMICAL LTD. et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of \_\_\_\_\_ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  14 MARCH 2001 (14.03.2001)	Date of completion of this report  21 DECEMBER 2001 (21.12.2001)
Name and mailing address of the IPEA/KR Korean Intellectual Property Office Government Complex-Daejeon, Dunsan-dong, Seo-gu, Daejeon Metropolitan City 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer  KIM, Hyun Sook  Telephone No. 82-42-481-5584





## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/KR00/00883

## I. Basis of the report

## 1. With regard to the elements of the international application:\*

- ☒ the international application as originally filed
- ☒ the description:  
pages 1 - 15, as originally filed  
pages none, filed with the demand  
pages none, filed with the letter of
- ☒ the claims:  
pages 16 - 20, as originally filed  
pages none, as amended (together with any statement) under Article 19  
pages none, filed with the demand  
pages none, filed with the letter of
- ☒ the drawings:  
pages none, as originally filed  
pages none, filed with the demand  
pages none, filed with the letter of
- ☒ the sequence listing part of the description:  
pages none, as originally filed  
pages none, filed with the demand  
pages none, filed with the letter of

## 2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language which is

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

## 3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheet

5. ☐ This opinion has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed." and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/KR00/00883

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	2, 6 - 8, 15 - 16	YES
	Claims	1, 3 - 5, 9 - 10, 12 - 14	NO
Inventive step (IS)	Claims	2, 6 - 8, 15 - 16	YES
	Claims	1, 3 - 5, 9 - 10, 12 - 14	NO
Industrial applicability (IA)	Claims	1 - 16	YES
	Claims		NO

**2. Citations and explanations (Rule 70.7)**

1. The present invention provides a photosensitive resin composition comprising a self-curable binder resin, a photopolymerization initiator, a crosslinking compound, which possesses in one molecule 2 or more ethylenically unsaturated groups and a solvent.

The self-curable binder, which is main point of the present invention, is the following components (A), (B) and (C) of chemical formulas.

The component (A) represents (meta)acrylic acid of amount 10 - 50 mole % and (B) is glycerol acrylate, which is obtained by reacting (meta)acrylic acid or acrylate with alkylene oxide, for example, propylene oxide, in an amount of 0 - 15 mole %, and then (C) is (meta)acrylate or styrene etc. 90 - 50 mole %.

2. Reference is made to the following documents:

D1:EP 0770923 A1

D2:US 5356754 A

D3:US 4692396 A

D4:US 4629680 A

D5:US 4495271 A

D6:US 4239849 A

D7:US 5419998 A

3. Document D1, which is considered to represent the most relevant state of the art, discloses(see D1, the claim 1, page 3 lines 42-56) photosensitive resin composition, which is composed of (A)urethane (meta)acrylate, (B)alkali-soluble polymer and (C)initiator. The component (B), which is correspondent to self-curable binder of the present invention, is a co-polymer of acrylic or methacrylic acid with comonomers, for example, glycerol acrylate, (meta)acrylate, which exist in D1, page 3 lines 42-56.

Consequently, the teaching of D1 is compatible and it is possible to arrive at the subject-matter of claim 1, by the teaching of D1.

Hence, the subject-matter of claim 1 is not novel and nor inventive in the sense of Article 33(2) and (3)

4. Document D2 discloses(see D2, the claims 1-4) crosslinking curable resin composition, which comprises:

(a) (meta)acryloyloxy group, which is obtained by reacting (meta)acrylic acid or acrylate with alkylene oxide, for example, propylene oxide.

(b) crosslinkable monomer possessing in one molecule 2 or more ethylenically unsaturated groups, which exist in D2, column 5 lines 53 - column 6. line 23.

(c) initiator

Consequently, the teaching of D2 is compatible, and it is possible to arrive at the subject-matter of claim 3 - 5, 9 - 10, 12 - 14 by the teaching of D2.

Hence, the subject-matter of claims 3 - 5, 9 - 10, 12 - 14 is not novel and inventive in the sense of Article 33(2) and (3).

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
22 February 2001 (22.02.2001)

PCT

(10) International Publication Number  
WO 01/13175 A3

(51) International Patent Classification<sup>7</sup>: G03F 7/027

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(21) International Application Number: PCT/KR00/00883

(22) International Filing Date: 10 August 2000 (10.08.2000)

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sam-dong, Kangnam-ku, Seoul 135-080 (KR).

(25) Filing Language: English

(81) Designated States (*national*): JP, US.

(26) Publication Language: English

(30) Priority Data:  
1999/33884 17 August 1999 (17.08.1999) KR

(84) Designated States (*regional*): European patent (AT, BE,  
CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC,  
NL, PT, SE).

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Published:  
— With international search report.

(88) Date of publication of the international search report:  
14 June 2001

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: PHOTSENSITIVE RESIN COMPOSITION

(57) Abstract: The present invention relates to a photosensitive resin composition capable of being developed by an alkaline aqueous solution, and provides a photosensitive resin which has superior resolving power by having a chemical bond between a binder resin and a crosslinking compound as well as a chemical bond between binder resin chains at an exposed area during an exposure process, thus maximizing a solubility difference between an exposed area and a non-exposed area during a developing process, and which has process benefits as well as superior film characteristics by reducing a consumed amount of a crosslinking compound, thus minimizing total amount of UV irradiation necessary.

WO 01/13175 A3

**PHOTOSENSITIVE RESIN COMPOSITION****CROSS REFERENCE TO RELATED APPLICATION**

This application is based on Korean patent application No. 10-1999-  
5 0033884 filed on August 17, 1999, which is incorporated hereinto by reference.

**BACKGROUND OF THE INVENTION****(a) Field of the Invention**

The present invention relates to a light-sensitive resin composition capable of being developed by an alkaline aqueous solution, more particularly  
10 to a photosensitive resin composition applicable to a color filter and for thin film transistor circuit passivation in the liquid crystal display manufacturing process.

**(b) Description of the Related Art**

Demand for photosensitive resins capable of being developed by an alkaline aqueous solution is recently increasing in many fields requiring micro  
15 image formation due to the so-called photolithography technology development in which images are formed using active lights such as ultraviolet rays, etc.

Alkaline developing type photosensitive resins have been used in dry film resists for printed circuit board fabrication, photoresists for semiconductor circuit fabrication, etc., and their applications such as color filter and various  
20 circuit passivation are recently being expanded into semiconductors and flat panel display fields, including liquid crystal displays.

A photosensitive resin composition capable of being developed by an alkaline aqueous solution generally comprises a) a binder resin which is dissolved or swelled by an alkaline solution; b) a crosslinking compound having  
25 at least two ethylenically unsaturated bonds; c) a photopolymerization initiator; and d) a solvent capable of dissolving the above mentioned constituents, in which dyestuff, pigment, or various additives which improve the filming property or adhesive property to the substrate can be contained if necessary.

The above a), as a binder resin which is dissolved or swelled by an

alkaline aqueous solution, generally comprising a structure containing carboxylic acid or a carboxylic acid anhydride or hydroxide group, an amino group, an amide group in the polymer chains, and a novolak based phenol resin, an acryl based resin homopolymer, or an acryl based resin copolymer, is widely used.

Particularly, an acryl based binder resin having superior transparency for visible light rays is widely being used when the photosensitive resin composition is used as a color filter and for thin film transistor circuit passivation in the flat panel display fields.

Copolymers using one or more compounds selected from the group consisting of acrylic acid, methacrylic acid, an alkyl ester thereof, and substituted or unsubstituted aryl esters are mainly used as acryl based binder resins soluble in the alkaline solution.

The use of benzyl acrylate/methacrylic acid copolymer is disclosed in U.S. Patent Nos. 4,629,680 and 4,139,391, methyl methacrylate/2-ethylhexyl methacrylate/methacrylic acid terpolymer is disclosed in Japanese Patent Publication No. Showa 54-34327, and methyl methacrylate/ethyl acrylate/acrylic acid terpolymer is disclosed in Japanese Patent Publication No. Showa 55-6210. Furthermore, a copolymer using allylacrylate, hydroxyalkyl acrylate, methacrylic acid, etc. is disclosed in Japanese Patent Laid-open Publication No. Heisei 9-23059.

A compound of the above b), as a crosslinking compound having at least two ethylenically unsaturated bonds, includes polyethylene glycol di(meth)acrylate, propylene glycol di(meth)acrylate, 1,3-butanediol di(meth)acrylate, neopentyl glycol di(meth)acrylate, 1,6-hexanediol di(meth)acrylate, trimethylolpropane tri(meth)acrylate, pentaerythritol tetra(meth)acrylate, dipentaerythritol penta(meth)acrylate, pentaerythritol hexa(meth)acrylate, etc.

In photosensitive resin compositions of existing technologies, this crosslinking compound is simply distributed in a binder resin of the composition, and when it is exposed to an active light such as ultraviolet rays, etc., a crosslinking reaction occurs and a network structure is formed preventing an

alkaline soluble resin from dissolving by a developer in the development process, consequently playing a role in the leaving of images on a substrate.

However, solubility differences between areas exposed to light and areas not exposed to light in existing photosensitive resin compositions are not large enough, and binder resin which should practically remain during the development process is partially dissolved by a development solution, and consequently it is difficult to obtain desirable micro patterned shapes in most cases.

On the other hand, when crosslinking compounds are excessively used to prevent this phenomena, not only are process properties decreased by surface hardness deterioration after exposure to light, but also process yields decrease as an exposing amount to light causing sufficient crosslinking reaction increases.

Furthermore, there is a disadvantage in this case that solubilities of the non-exposed areas are also deteriorated, thus reducing the resolving power as a resist.

### **SUMMARY OF THE INVENTION**

It is an object of the present invention to provide a photosensitive resin which has superior resolving power by having a chemical bond between a binder resin and a crosslinking compound as well as a chemical bond between binder resin chains at an exposed area during an exposing process, thus maximizing the solubility difference between an exposed area and a non-exposed area during the developing process, and which has process benefits as well as superior film characteristics by reducing the consumed amount of crosslinking compound, thus decreasing total exposed light quantity in order to solve the above described problems.

The present invention provides a photosensitive resin composition comprising a self-curable binder resin, a photopolymerization initiator, a crosslinking compound having at least two ethylenically unsaturated bonds, and a solvent, wherein the self-curable binder resin is the following Chemical Formula 1:

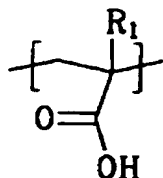
4

[Chemical Formula 1]

- A - B - C -

where A is a compound represented as in the following Chemical Formula 1-A;

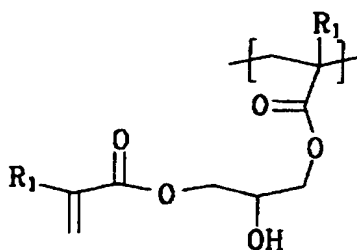
[Chemical Formula 1-A]



5

B is a compound represented as in the following Chemical Formula 1-B;

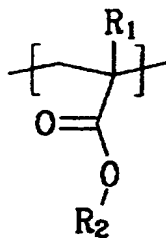
[Chemical Formula 1-B]



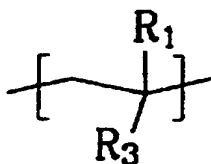
C is a compound represented as in the following Chemical Formula 1-C

10 and / or Chemical Formula 1-C';

[Chemical Formula 1-C]



[Chemical Formula 1-C']



15

wherein  $R_1$  is H or  $\text{CH}_3$ ,  $R_2$  is an alkyl group having 1 to 8 carbon atoms, a hydroxy group substituted alkyl group, or a substituted or unsubstituted aryl group having 1 to 12 carbon atoms, and  $R_3$  is a benzene, an alkyl group having 1 to 8 carbon atoms, an alkoxy group having 1 to 8 carbon atoms, a benzene

5

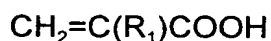
having a  $C_1 \sim C_6$  alkyl substituent, a benzene having a  $C_1 \sim C_8$  alkoxy substituent, or a hydroxide group or a halogen substituted benzene.

The A portion in the binder resin of Chemical Formula 1 accounts for 10 to 50 mol%, the B portion accounts for 0 to 15 mol%, and the C portion  
5 accounts for 50 to 90 mol% of the total binder resin.

A crosslinking compound having at least two unsaturated groups can further be used in the photosensitive resin composition if necessary.

A self-curable binder resin of the Chemical Formula 1 is obtained by reacting a copolymer comprising a constituent of a compound having one or  
10 more carboxylic acids selected from the group consisting of the following Chemical Formulae 2, 3, and 4 with a compound of the following Chemical Formula 5.

[Chemical Formula 2]



15

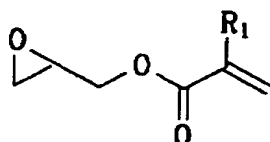
[Chemical Formula 3]



[Chemical Formula 4]



[Chemical Formula 5]



20

wherein  $R_1$  is hydrogen or a methyl group,  $R_2$  is a compound selected from the group consisting of an alkyl group having 1 to 8 carbon atoms, a hydroxy group substituted alkyl group, and a substituted or unsubstituted aryl group or arylalkyl group having 4 to 12 carbon atoms, and  $R_3$  is a compound  
25 selected from the group consisting of a benzene, an alkyl group having 1 to 8 carbon atoms, an alkoxy group having 1 to 8 carbon atoms, a benzene having a  $C_1 \sim C_6$  alkyl substituent, a benzene having a  $C_1 \sim C_8$  alkoxy substituent, and a hydroxide group or halogen substituted benzene.

A copolymer which is prepared by copolymerizing a self-curable binder



resin of the Chemical Formula 1 with one or both of a compound of the Chemical Formula 2 and a compound of the Chemical Formula 3 or Chemical Formula 4 in a certain mole ratio is put into a flask with a stirrer and a nitrogen injecting hole attached, and then dissolved using a solvent such as methyl ethyl ketone, etc. A number average molecular weight of a copolymer to be used is 1,000 to 100,000 and preferably 2,000 to 30,000.

After increasing the flask temperature to 120 °C and slowly adding a compound of Chemical Formula 5 over one hour, the solution is reacted until an epoxy group is completely removed. A self-curable binder resin is prepared by forming precipitates from the reactant using a mixture with a ratio of n-hexane and methanol of 1:1, and drying the precipitates under vacuum.

An epoxy group of a compound of Chemical Formula 5 is reacted with carboxylic acid existing in the binder resin and forming an ester consequently forming a self-curable binder resin, wherein a reactive (meth)acryl group is employed in the linear binder resin as a branch.

This obtained self-curable binder resin, as a resin which is dissolved or at least swelled by an alkaline aqueous solution, can cause the curing reaction by using an active light such as ultraviolet rays, etc.

Furthermore, the present invention provides a photosensitive resin composition prepared by mixing a copolymer in which a compound of the Chemical Formula 2 is copolymerized with one or both compounds of a compound of the Chemical Formula 3 and a compound of the Chemical Formula 4, a photopolymerization initiator, and a solvent.

While existing photosensitive resin components form a network structure by chemical reactions which occurs between only crosslinking compounds each other in UV exposure process, the photosensitive resin composition of the present invention forms a network structure not only with the crosslinking compounds but also with binder resin chains. Because of this, the photosensitive resin composition of the present invention provides the maximized solubility deference between an exposed area and a non exposed. Thus it can be obtained the superior film characteristics as well as the excellent

sensitivity and resolution by reducing the amount of crosslinking compound or not using it.

Acrylic acid, methacrylic acid, etc. can be used as a compound of the Chemical Formula 2, and its consumed amount is from 10 to 90 mol% based on  
5 the mole sum of total monomers in the copolymer.

A compound of the Chemical Formula 3 is preferably a compound selected from the group consisting of benzyl(meth)acrylate, phenyl(meth)acrylate, cyclohexyl(meth)acrylate, methyl(meth)acrylate, ethyl(meth)acrylate, or 2-ethylhexyl(meth)acrylate, and more preferably  
10 benzyl(meth)acrylate or phenyl(meth)acrylate.

A compound of the Chemical Formula 4 is preferably a compound selected from the group consisting of styrene, 4-hydroxystyrene, 4-methylstyrene, or vinyl acetate.

Furthermore, a compound of the Chemical Formula 5 is preferably  
15 glycidyl acrylate or glycidyl methacrylate. This compound uses 0.1 to 90 mol% of the carboxylic acid contained monomer in Chemical Formula 2.

A crosslinking compound having at least two unsaturated groups which can be used in the present invention if necessary includes a compound selected from the group consisting of polyethylene glycol di(meth)acrylate, propylene  
20 glycol di(meth)acrylate, 1,3-butanediol di(meth)acrylate, neopentyl glycol di(meth)acrylate, 1,6-hexanediol di(meth)acrylate, trimethylolpropane tri(meth)acrylate, pentaerythritol di(meth)acrylate, pentaerythritol tri(meth)acrylate, pentaerythritol tetra(meth)acrylate, pentaerythritol hexa(meth)acrylate, dipentaerythritol penta(meth)acrylate, dipentaerythritol  
25 hexa(meth)acrylate, trimethylolpropane triacrylate, and a mixture thereof, and preferably includes dipentaerythritol penta(meth)acrylate and dipentaerythritol hexa(meth)acrylate.

The content of the crosslinking compound is from 0 to 200 weight%, and preferably from 0 to 150 weight%, based on the total weight of the self-  
30 curable binder resin.

A photopolymerization initiator example is a compound selected from the group consisting of benzophenones such as benzophenone and

acetophenone; substituted benzophenones such as bis-4,4'-dimethylaminobenzophenone and bis-4,4'-diethylaminobenzophenone; triazine based photoinitiators such as 2,4,6-tris(trichloromethyl)-triazine; ketone based photopolymerization initiators such as N-methyl-2-benzoylmethylene- $\beta$ -naphthothiazole and 2,2-dimethoxy-1,2-diphenylethanone; and a mixture thereof.

The content of the photopolymerization initiator is preferably from 0.1 to 10 weight% based on the total weight of the photopolymerizable composition.

A general solvent mainly used in the polymerization of acryl polymer, is a compound selected from the group consisting of methylethylketone, cyclohexanone, tetrahydrofuran, methyl cellosolve, methyl cellosolve acetate, dimethyl formamide, propylene glycol methylether acetate, 2-methoxyethylether, and a mixture thereof.

On the other hand, small amounts of a pigment, a dyestuff, an antifoaming agent for increasing filming properties, a surfactant, a thermal polymerization preventing agent, an adhesion promoter, etc. in addition to the above basic components can be used in a photosensitive resin composition of the present invention if necessary.

The finally obtained photosensitive resin composition solution is filtered using a membrane filter having 0.1 to 5  $\mu\text{m}$  pores. This filtered resin composition is filmed using a notified method such as a spin coating method, a roll coating method, a spray coating method, etc. A glass plate or a silicone wafer can be used as a filming substrate, wherein the film surface thickness is determined by filming conditions such as composition viscosity, concentration of solid content, filming rate, etc., and a 0.1 to 500  $\mu\text{m}$  thick thin film can be obtained using a composition of the present invention.

The obtained thin film is pretreated by maintaining a temperature of 50 to 150  $^{\circ}\text{C}$  at a heating plate or an oven for 10 to 500 seconds.

Ultraviolet rays are irradiated on the somewhat dried thin film through a positive type test photomask (made by Toppan Printing Co., Ltd.), wherein the ultraviolet ray light is irradiated in the intensity of illumination of from about 30 to 500  $\text{mJ}/\text{cm}^2$  using a 1 kW high pressure mercury lamp, etc. containing g, h, and

i lines, and particular optical filters are not used.

The solubility of the ultraviolet ray irradiated area becomes far less than that of the non-ultraviolet ray irradiated area, thus maximizing the solubility difference between them.

- 5           The ultraviolet ray irradiated thin film is developed by a spray method or a dipping method at a temperature of 20 to 30 °C, wherein a KOH aqueous solution having from 9 to 12 pH or 0.1 to 5 weight% of tetramethylammonium hydride aqueous solution can be used as a developer.

### **DETAILED DESCRIPTION OF THE INVENTION**

- 10           In the following detailed description, only the preferred embodiments of the invention have been shown and described, simply by way of illustration of the best mode contemplated by the inventor(s) of carrying out the invention. As will be realized, the invention is capable of modification in various obvious respects, all without departing from the invention. Accordingly, the description  
15 is to be regarded as illustrative in nature, and not restrictive.

- Preferable SYNTHESIZING EXAMPLES and EXAMPLES are described as follows in order to help understand the present invention. However, the following SYNTHESIZING EXAMPLES and EXAMPLES are only for help understand the present invention, and the present invention is not  
20 limited to the following SYNTHESIZING EXAMPLES and EXAMPLES.

#### **[SYNTHESIZING EXAMPLE 1]**

- 10 g of copolymer in which the mole ratio of benzylmethacrylate : methacrylic acid is 60 : 40, and the number average molecular weight is 10,000 were put into a flask with a stirrer and a nitrogen injecting hole attached and  
25 dissolved using 100  $\mu$ m of methyl ethyl ketone. After increasing the flask temperature to 120 °C and slowly adding 0.3 g of glycidyl methacrylate over one hour, the solution was reacted until epoxy groups were completely removed. Precipitates were formed from the reactant using a mixture of a ratio of n-hexane and methanol of 1:1, and dried under vacuum thereby obtaining a  
30 binder resin.

## [SYNTHESIZING EXAMPLE 2]

A binder resin was obtained according to the method of SYNTHESISING EXAMPLE 1 except that 10 g of copolymer in which the mole ratio of benzylmethacrylate : methacrylic acid was 50 : 50 and the number  
5 average molecular weight was 15,000 were used, and 0.6 g of glycidyl acrylate were also used.

## [SYNTHESIZING EXAMPLE 3]

A binder resin was obtained according to the method of SYNTHESISING EXAMPLE 1 except that 10 g of copolymer in which the mole  
10 ratio of benzylmethacrylate : methacrylic acid was 70 : 30 and the number average molecular weight was 15,000 were used, and 0.05 g of glycidyl acrylate were also used.

## [SYNTHESIZING EXAMPLE 4]

A binder resin was obtained according to the method of  
15 SYNTHESISING EXAMPLE 1 except that 10 g of copolymer in which the mole ratio of benzylmethacrylate : methacrylic acid was 70 : 30 and the number average molecular weight was 10,000 were used, and 0.04 g of glycidyl acrylate were also used.

## [SYNTHESIZING EXAMPLE 5]

20 A binder resin was obtained according to the method of SYNTHESISING EXAMPLE 1 except that 10 g of terpolymer in which the mole ratio of ethylmethacrylate : methacrylic acid : styrene was 50 : 40 : 10 and the number average molecular weight was 14,500 were used, and 0.3 g of glycidyl acrylate were also used.

## 25 [SYNTHESIZING EXAMPLE 6]

A binder resin was obtained according to the method of SYNTHESISING EXAMPLE 1 except that 10 g of terpolymer in which the mole ratio of ethylmethacrylate : methacrylic acid : styrene was 60 : 30 : 10 and the number average molecular weight was 14,500 were used, and 0.05 g of glycidyl  
30 acrylate were also used.

A photosensitive resin composition of the present invention was prepared using a binder resin prepared in the above SYNTHESIZING

## EXAMPLES 1 to 6.

## [EXAMPLE 1]

A photosensitive resin composition was prepared in compositions represented as in the following Table 1.

5 [Table 1]

A binder resin prepared in SYNTHESIZING EXAMPLE 1	5 g
Bis-4,4'-diethylaminobenzophenone	2 g
Propylene glycol methyl ether acetate	20 g

The above prepared composition solution was filtered using a Teflon membrane filter having 0.2  $\mu\text{m}$  pores. A photosensitive resin composition was coated on a glass plate using a spin method, put on a heating plate, and maintained at a temperature of 80  $^{\circ}\text{C}$  for three minutes. Subsequently, after putting a positive type test photomask (made by Toppan Printing Co., Ltd.) as a contacting method on a thin film, ultraviolet rays were irradiated thereon, wherein ultraviolet ray light was irradiated at the intensity of illumination of 100  $\text{mJ}/\text{cm}^2$  using a 1 kW high pressure mercury lamp containing g, h, and i lines, and particular optical filters were not used. The ultraviolet ray irradiated thin film was developed by dipping it into a KOH aqueous solution developer having a pH of 10.5, for two minutes. After washing the thin film coated glass plate with distilled water, it was dried by blowing nitrogen gas and heated in a heating oven at 250  $^{\circ}\text{C}$  for one hour. The obtained film thickness was 3.5  $\mu\text{m}$  and clear patterns having 8  $\mu\text{m}$  of line width and gap could be obtained.

## [EXAMPLE 2]

A photosensitive resin composition was prepared in compositions represented as in the following Table 2.

[Table 2]

A binder resin prepared in SYNTHESIZING EXAMPLE 2	5 g
Bis-4,4'-diethylaminobenzophenone	2 g
Propylene glycol methyl ether acetate	20 g

A film was formed from the above prepared photosensitive resin

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composition in a method as in EXAMPLE 1, exposed at the intensity of illumination of 100 mJ/cm<sup>2</sup>, and developed.

The obtained film thickness was 3.5  $\mu\text{m}$  and clear patterns having 7  $\mu\text{m}$  of line width and gap could be obtained.

#### 5 [EXAMPLE 3]

A photosensitive resin composition was prepared in compositions represented as in the following Table 3.

[Table 3]

A binder resin prepared in SYNTHESIZING EXAMPLE 3	5 g
Bis-4,4'-diethylaminobenzophenone	2 g
Propylene glycol methyl ether acetate	20 g

10 A film was formed from the above prepared photosensitive resin composition in a method as in EXAMPLE 1, exposed at the intensity of illumination of 150 mJ/cm<sup>2</sup>, and developed.

The obtained film thickness was 4.0  $\mu\text{m}$  and clear patterns having 9  $\mu\text{m}$  of line width and gap could be obtained.

#### 15 [EXAMPLE 4]

A photosensitive resin composition was prepared in compositions represented as in the following Table 4.

[Table 4]

A binder resin prepared in SYNTHESIZING EXAMPLE 4	4 g
Bis-4,4'-diethylaminobenzophenone	2 g
Propylene glycol methyl ether acetate	30 g
Pentaerythritol tetramethacrylate	4 g

20 A film was formed from the above prepared photosensitive resin composition in a method as in EXAMPLE 1, exposed at the intensity of illumination of 150 mJ/cm<sup>2</sup>, and developed.

The obtained film thickness was 4.5  $\mu\text{m}$  and clear patterns having 8  $\mu\text{m}$  of line width and gap could be obtained.

#### 25 [EXAMPLE 5]

A photosensitive resin composition was prepared in compositions represented as in the following Table 5.

[Table 5]

A binder resin prepared in SYNTHESIZING EXAMPLE 5	5 g
Bis-4,4'-diethylaminobenzophenone	2 g
Propylene glycol methyl ether acetate	20 g

- 5 A film was formed from the above prepared photosensitive resin composition in a method as in EXAMPLE 1, exposed at the intensity of illumination of 150 mJ/cm<sup>2</sup>, and developed.

The obtained film thickness was 3.8  $\mu\text{m}$  and clear patterns having 9  $\mu\text{m}$  of line width and gap could be obtained.

10 [EXAMPLE 6]

A photosensitive resin composition was prepared in compositions represented as in the following Table 6.

[Table 6]

A binder resin prepared in SYNTHESIZING EXAMPLE 6	5 g
Bis-4,4'-diethylaminobenzophenone	3 g
Propylene glycol methyl ether acetate	40 g
Pentaerythritol tetraacrylate	2 g

- 15 A film was formed from the above prepared photosensitive resin composition in a method as in EXAMPLE 1, exposed at the intensity of illumination of 100 mJ/cm<sup>2</sup>, and developed.

The obtained film thickness was 3.1  $\mu\text{m}$  and clear patterns having 7  $\mu\text{m}$  of line width and gap could be obtained.

20 [EXAMPLE 7]

A photosensitive resin composition was prepared in compositions represented as in the following Table 7. A photosensitive resin composition was prepared not by synthesizing a binder resin first, but by putting the starting material together with constituents comprising the photosensitive resin composition in the present EXAMPLE 7, different from the above EXAMPLES.

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[Table 7]

Benzylmethacrylate/methacrylic acid copolymer (mole ratio = 60/40, number average molecular weight = 10000)	5 g
Glycidyl methacrylate	0.15 g
Bis-4,4'-diethylaminobenzophenone	2 g
Propylene glycol methyl ether acetate	20 g

A film was formed from the above prepared photosensitive resin composition in a method as in EXAMPLE 1, exposed at the intensity of illumination of 150 mJ/cm<sup>2</sup>, and developed.

The obtained film thickness was 3.6  $\mu\text{m}$  and clear patterns having 8  $\mu\text{m}$  of line width and gap could be obtained.

## [COMPARATIVE EXAMPLES 1 to 3]

A photosensitive resin composition was prepared in compositions represented as in the following Table 8.

[Table 8]

Benzylmethacrylate/methacrylic acid copolymer (mole ratio = 70/30, number average molecular weight = 10000)	5 g
Pentaerythritol tetra(meth)acrylate	5 g
Bis-4,4'-diethylaminobenzophenone	2 g
Propylene glycol methyl ether acetate	40 g

The results were obtained as in the following Table 9 by forming patterns as changing exposed light quantity after forming a film using the above obtained photosensitive resin composition in a method as in EXAMPLE 1.

[Table 9]

Classification	COMPARATIVE EXAMPLE 1	COMPARATIVE EXAMPLE 2	COMPARATIVE EXAMPLE 3
Exposed light quantity	100 mJ/cm <sup>2</sup>	150 mJ/cm <sup>2</sup>	200 mJ/cm <sup>2</sup>
Film thickness	-	3.0 $\mu\text{m}$	3.8 $\mu\text{m}$
Resolving power	Pattern lost	20 $\mu\text{m}$	10 $\mu\text{m}$

According to the results obtained from EXAMPLES 1 to 7, in the case of

forming a thin film using a photosensitive resin composition using a self-curable binder resin prepared in accordance with the present invention, the obtained thin film thickness was 3 to 5  $\mu\text{m}$  and clear patterns having 7 to 9  $\mu\text{m}$  of line width and gap could be obtained when the exposed light quantity was irradiated at the intensity of illumination of 100 to 150  $\text{mJ}/\text{cm}^2$ .

On the contrary, patterns themselves were lost when the exposed light quantity was 100  $\text{mJ}/\text{cm}^2$  in the case of photosensitive resin compositions of COMPARATIVE EXAMPLES 1 to 3 in which self-curable binder resins were not used, and the thin film thickness was 3.0 to 3.8  $\mu\text{m}$ , and the line width and gap were decreased from 20  $\mu\text{m}$  to 10  $\mu\text{m}$  when the exposed light quantity was increased to 150 to 200  $\text{mJ}/\text{cm}^2$ . Therefore, it can be seen that clear patterns can be obtained as the exposed light quantity increases in the case of a photosensitive resin composition in which a self-curable binder resin is not used, and the increase of exposed light quantity means an increase in process time. Furthermore, it can be seen that clearer and finer patterns than the results of EXAMPLES according to the present invention could not be obtained since the thickness of the thin film pattern was represented as 3.8  $\mu\text{m}$  and the line width and gap were represented as 10  $\mu\text{m}$  even when the exposed light quantity was 200  $\text{mJ}/\text{cm}^2$ .

Therefore, the present invention can provide a photosensitive resin composition having process benefits, and superior resolving power and film properties since although less exposed light quantity is applied, a photosensitive resin composition using a self-curable binder resin can obtain much clearer and finer patterns compared with existing compositions, thus shortening time of UV exposure process.

While the present invention has been described in detail with reference to the preferred embodiments, those skilled in the art will appreciate that various modifications and substitutions can be made thereto without departing from the spirit and scope of the present invention as set forth in the appended claims.

**WHAT IS CLAIMED IS:**

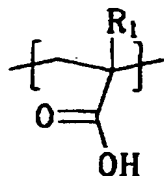
1. A photosensitive resin composition comprising a self-curable binder resin, a crosslinking compound having at least two ethylenically unsaturated bonds, a photopolymerization initiator, and a solvent, wherein the self-curable binder resin is a compound represented as in the following Chemical Formula 1:

[Chemical Formula 1]

- A - B - C -

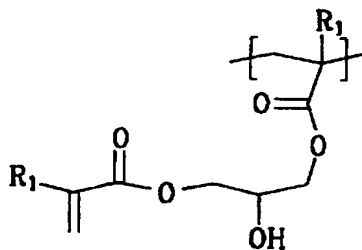
where A is a compound represented as in the following Chemical Formula 1-A;

[Chemical Formula 1-A]



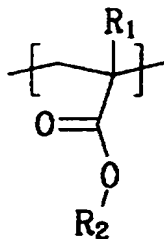
where B is a compound represented as in the following Chemical Formula 1-B;

[Chemical Formula 1-B]

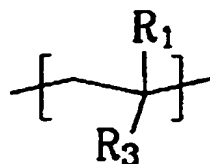


where C is a compound represented as in the following Chemical Formula 1-C and/or Chemical Formula 1-C';

[Chemical Formula 1-C]



[Chemical Formula 1-C']



wherein  $R_1$  is H or  $-\text{CH}_3$ ,  $R_2$  is an alkyl group having 1 to 8 carbon atoms, a hydroxyl group substituted alkyl group, or a substituted or unsubstituted aryl group having 1 to 12 carbon atoms, and  $R_3$  is a benzene, an alkyl group having 1 to 8 carbon atoms, an alkoxy group having 1 to 8 carbon atoms, a benzene having a  $\text{C}_1 \sim \text{C}_6$  alkyl substituent, a benzene having a  $\text{C}_1 \sim \text{C}_8$  alkoxy substituent, or a hydroxide group or halogen substituted benzene.

2. A photosensitive resin composition in accordance with claim 1, wherein an A portion in a binder resin of the Chemical Formula 1 accounts for 10 to 50 mol%, a B portion accounts for 0 to 15 mol%, and a C portion accounts for 90 to 50 mol% based on the total binder resin.

3. A photosensitive resin composition in accordance with claim 1, wherein the self-curable binder resin is a self-curable binder resin obtained by reacting a copolymer which is prepared by copolymerizing a compound of the following Chemical Formula 2 with one or both of a compound of the following Chemical Formula 3 and a compound of the following Chemical Formula 4 with a compound of the following Chemical Formula 5:

[Chemical Formula 2]

20  $\text{CH}_2=\text{C}(\text{R}_1)\text{COOH}$

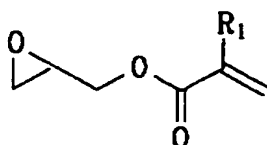
[Chemical Formula 3]

$\text{CH}_2=\text{C}(\text{R}_1)\text{COOR}_2$

[Chemical Formula 4]

$\text{CH}_2=\text{C}(\text{R}_1)-\text{R}_3$

25 [Chemical Formula 5]



wherein  $R_1$  is hydrogen or a methyl group,  $R_2$  is a compound selected

from the group consisting of an alkyl group having 1 to 8 carbon atoms, a hydroxy group substituted alkyl group, and a substituted or unsubstituted aryl group or arylalkyl group having 4 to 12 carbon atoms, and  $R_3$  is a compound selected from the group consisting of a benzene, an alkyl group having 1 to 8 carbon atoms, an alkoxy group having 1 to 8 carbon atoms, a benzene having a  $C_1 \sim C_6$  alkyl substituent, a benzene having a  $C_1 \sim C_8$  alkoxy substituent, and a hydroxide group or halogen substituted benzene.

4. A photosensitive resin composition in accordance with claim 3, wherein a compound of the Chemical Formula 2 comprising the copolymer is acrylic acid or methacrylic acid, a compound of the Chemical Formula 3 is a compound selected from the group consisting of benzyl(meth)acrylate, phenyl(meth)acrylate, cyclohexyl(meth)acrylate, methyl(meth)acrylate, ethyl(meth)acrylate, and 2-ethylhexyl(meth)acrylate, and a compound of the Chemical Formula 4 is a compound selected from the group consisting of styrene, 4-hydroxystyrene, 4-methylstyrene, and vinyl acetate.

5. A photosensitive resin composition in accordance with claim 3, wherein a compound of the Chemical Formula 5 is glycidyl acrylate or glycidyl methacrylate.

6. A photosensitive resin composition in accordance with claim 3, wherein a number average molecular weight of the copolymer is from 1,000 to 100,000.

7. A photosensitive resin composition in accordance with claim 3, wherein a compound amount of the Chemical Formula 5 is from 0.1 to 90 mol% based on a carboxylic acid containing monomer of Chemical Formula 2 in a binder resin of Chemical Formula 1.

8. A photosensitive resin composition in accordance with claim 3, wherein a compound amount of the Chemical Formula 2 is from 10 to 90 mol% based on the mole sum of Chemical Formulae 2, 3, and 4.

9. A photosensitive resin composition in accordance with claim 1, further comprising a crosslinking compound having at least two unsaturated groups.

10. A photosensitive resin composition in accordance with claim 9,

wherein the crosslinking compound is a compound selected from the group consisting of polyethylene glycol di(meth)acrylate, propylene glycol di(meth)acrylate, 1,3-butanediol di(meth)acrylate, neopentyl glycol di(meth)acrylate, 1,6-hexanediol di(meth)acrylate, trimethylolpropane tri(meth)acrylate, pentaerythritol di(meth)acrylate, pentaerythritol tri(meth)acrylate, pentaerythritol tetra(meth)acrylate, pentaerythritol hexa(meth)acrylate, dipentaerythritol penta(meth)acrylate, dipentaerythritol hexa(meth)acrylate, trimethylolpropane triacrylate, and a mixture thereof.

11. A photosensitive resin composition in accordance with claim 9, wherein the crosslinking compound amount is from 0 to 200 weight% based on the self-curable binder resin of Chemical Formula 1.

12. A photosensitive resin composition prepared by mixing a copolymer which is prepared by copolymerizing a compound of the following Chemical Formula 2 and one or both of a compound of the following Chemical Formula 3 and a compound of the following Chemical Formula 4 with a compound of the following Chemical Formula 5, a photoinitiator, and a solvent:

[Chemical Formula 2]



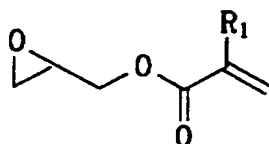
[Chemical Formula 3]



[Chemical Formula 4]



[Chemical Formula 5]



wherein  $\text{R}_1$  is hydrogen or methyl group,  $\text{R}_2$  is a compound selected from the group consisting of an alkyl group having 1 to 8 carbon atoms, a hydroxy group substituted alkyl group, and a substituted or unsubstituted aryl group or arylalkyl group having 4 to 12 carbon atoms, and  $\text{R}_3$  is a compound selected from the group consisting of a benzene, an alkyl group having 1 to 8

carbon atoms, an alkoxy group having 1 to 8 carbon atoms, a benzene having a  $C_1 \sim C_6$  alkyl substituent, a benzene having a  $C_1 \sim C_8$  alkoxy substituent, and a hydroxide group or halogen substituted benzene.

13. A photosensitive resin composition in accordance with claim 12,  
5 wherein a compound of the Chemical Formula 2 comprising the copolymer is acrylic acid or methacrylic acid, a compound of the Chemical Formula 3 is a compound selected from the group consisting of benzyl(meth)acrylate, phenyl(meth)acrylate, cyclohexyl(meth)acrylate, methyl(meth)acrylate, ethyl(meth)acrylate, and 2-ethylhexyl(meth)acrylate, and a compound of the  
10 Chemical Formula 4 is a compound selected from the group consisting of styrene, 4-hydroxystyrene, 4-methylstyrene, and vinyl acetate.

14. A photosensitive resin composition in accordance with claim 12, wherein a compound of the Chemical Formula 5 is glycidyl acrylate or glycidyl methacrylate.

- 15 15. A photosensitive resin composition in accordance with claim 12, wherein a number average molecular weight of the copolymer is from 1,000 to 100,000.

16. A photosensitive resin composition in accordance with claim 12, wherein a compound amount of the Chemical Formula 2 is from 10 to 90 mol%  
20 based on the mole sum of Chemical Formulae 2, 3, and 4.